Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 8, Number 1, March 2024

FACTORS ENHANCING THE IMPLEMENTATION OF SUPPLY CHAIN MANAGEMENT PRACTICES IN NIGERIA

[1]Asuquo Henry Okpo, [2]Timothy Adewuyi and [3]Anthony Ujene

[1] Department of Building Technology, Akwa Ibom State Polytechnic, Ikot Osurua.

[2&3] Department of Building, University of Uyo, Nigeria.

ABSTRACT

Purpose: Despite the growing importance of supply chain management (SCM) in the construction industry, many construction firms in Nigeria are yet to effectively implement SCM practices. This has led to inefficiencies, delays, cost overruns and poor project outcomes. Therefore, there is a need to establish factors that enhance the implementation of SCM in construction firms in Nigeria.

Design/methodology/approach: Anchored on survey research design using a questionnaire survey, a total of 500 copies of structured questionnaires were randomly distributed to medium and large-sized construction firms in Nigeria. A total of 402 valid responses were received giving an overall response rate of 80%. The responses were analysed using mean item scores, coefficient of variation (COV), factor analysis and Mann-Whitney U test to measure differences in perceptions.

Findings: The study established undertaking digital transformation/technological innovation, top management support, external support (vendors, subcontractors, and government), developing adequate knowledge and experience, change management (readiness for change) and ensuring compliance with regulations and standards as critical factors enhancing the implementation of SCM.

Originality/value: The study has provided enhancers of SCM to help construction firms in Nigeria implement SCM. The study contributes to the body of knowledge on construction SCM and provides practical recommendations for improving supply chain performance. The study recommends investments in digital transformation, training and skill development for enhancement of SCM capabilities.

Keywords: Construction Firms, Construction Industry, Factor Enhancing, and SCM Implementation.

1. INTRODUCTION

Nigeria's construction industry (CI) has significantly boosted the economy, reduced unemployment, and provided housing. The sector generated 4.13% of GDP in Q1 2016, making it a cornerstone of infrastructure development and a crucial factor in economic expansion (National Bureau of Statistics, 2016). CI products, such as roads, infrastructure, water supplies, and power lines, support various industries and employ the unemployed and unskilled in developing countries like Nigeria (Boadu *et al.,* 2020). Nigeria's construction sector (CI) contributed 6.17% of the country's GDP in the first quarter of 2019 (Oludare *et al.,* 2018), but experienced a decline in 2021 due to disruptions in construction material supply. To minimize disruption, construction supply

[1]Email: henryokpo24@gmail.com

chain management (SCM) techniques must be applied. SCM involves connecting multiple construction firms to provide items to customers using a single method, technique, and set of activities. Key SCM practices include process integration, risk and award sharing, information sharing, long-term connections, cooperation, and leadership. The five best SCM approaches identified by McKinsey Global Institute (2017) and Studer and De Brito Mello (2021) are just-in-time, lean thinking, continuous improvement, offshore manufacturing, and sustainability. By incorporating long-term partnerships and trust among supply chain partners, SCM strategies could transform the Nigerian construction sector and become an essential player in the country's economy. Amade *et al.* (2017) posited that SCM practices must incorporate long-term partnerships and trust among supply chain partners. As a result, if SCM principles are applied at a high level, the construction sector in Nigeria might become an indisputable player in the country's economy, and SCM practices could completely transform the sector.

The construction sectors face numerous challenges, including delays, overruns, and corruption. Nigeria's construction sector faces issues like a lack of skilled workers, power shortages, and unavailability of materials. Ineffective policies, weak institutions, and complex social and cultural practices contribute to the industry's challenges (Ayodele *et al.*, 2011 and Oyewobi *et al.*, 2011). Despite these challenges, the construction sector remains a significant contributor to global GDP and workforce (McKinsey Global Institute, 2017). Nigeria's construction industry faces significant performance challenges due to a lack of resources and organisations. The construction sector is fragmented, with contractors, subcontractors, and suppliers all contributing to project control. For the construction industry to overcome these issues effective implementation of SCM should be the critical solution. This can only be achievable if construction firms explore factors enhancing the implementation of SCM.

Construction firms need to implement SCM to compete in the worldwide market. Uncertainties in supply and demand may be brought on by competing goals and a lack of collaboration among supply chain participants. Because of this, medium- and large-scale construction firms' supply chains must be optimized through efficient SCM. The factors enhancing the implementation of SCM have been the subject of numerous studies, but none of them has looked at these factors from the viewpoint of medium and large-size construction firms. Due to a dearth of resources and guidance, construction firms in Nigeria and other emerging nations have difficulty implementing SCM. There is a significant gap in research on factors enhancing the implementation of SCM in Nigeria, despite the growing importance of SCM in Nigeria’s economic development, few studies have focused on those factors. Notwithstanding, several studies conducted on factors enhancing/enabling the implementation of SCM practices across the globe, there is limited information in the literature on factors enhancing the implementation of SCM practices in the Nigerian construction industry. Thus, presenting empirical and knowledge gaps. In light of this, the study seeks to establish factors enhancing the implementation of SCM in Nigeria, to enhance supply chain operations.

H_{01}: there is no significant difference in factors enhancing the implementation of SCM between medium and large-scale construction firms in Nigeria.

2. LITERATURE REVIEW

The concept of SCM has been increasingly applied to the construction sector to improve business performance such as faster response to a variety of customer demands, lower cost, and better quality. Simultaneously, the application of SCM concepts in the construction sector is commonly used to instruct the project team in strategic, tactical and operational planning to achieve supplier relationships and attain high operational efficiency (Singh *et al.*, 2022). Although, SCM can be strengthened using effective communication, integration, collaboration, and coordination between stakeholders throughout the project (Singh *et al.*, 2022), understanding SCM in the construction

industry is complex due to its high fragmentation and dynamic nature (Cheng *et al.*, 2019).

SCM practices involve the coordination and optimisation of all activities involved in the production and delivery of goods and services to customers. Implementing effective supply chain management practices is crucial for improving efficiency, reducing costs, and enhancing customer satisfaction (Barata *et al.*, 2023). The construction industry is a complex and dynamic industry with multiple stakeholders involved in the project supply chain. SCM practices are effective in managing the complexities of the supply chain in various industries. However, the adoption of SCM practices in the construction industry has been slow, despite the potential benefits.

Developing a comprehensive supply chain strategy is a vital tool for implementing SCM in contracting organisations. Organisations need to develop a comprehensive supply chain strategy that aligns with their overall business strategy. This strategy should outline the goals, objectives, and key performance indicators that will guide the implementation of supply chain management practices (Christopher, 2016). The company's primary resources, which are a source of competitive advantage, are limited to resources within the company's organisation and the organisation as part of the SCM systems. An important task for top management is to manage the supply chain at the most cost-efficient level while maintaining high flexibility in building relationships with suppliers to respond to customer needs (Nurdianti *et al.*, 2017).

Increased competition in business, increasingly complex customer demands, and more and more products are emerging. Currently, many factors trigger companies to compete to create innovative products (Barata *et al.*, 2023). This is done to increase competitive advantage. A well-integrated network within a corporation is essential for increasing this competitiveness. Companies in the production, importation, and service industries have long recognised the value of optimising their supply chains to cut costs and improve their position in the market (Barata *et al.*, 2023). Reducing costs and increasing competitiveness can be achieved by employing SCM to coordinate the flow of information, products, and materials between companies' suppliers and distributors. The rise of technology and the internet has unquestionably transformed the way businesses operate and provided new avenues for gaining a competitive advantage (Figures, 2017; Barata *et al.*, 2023).

Information sharing has been identified as another key strategy for adopting SCM practices in the construction industry. This includes sharing information on project schedules, budgets, and quality requirements (Kim *et al.*, 2019). Information sharing plays a vital role in SC integration. SC integration involves the coordination and collaboration of all stakeholders in the supply chain. This can be achieved through the use of technology, such as Building Information Modelling (BIM), to facilitate communication and collaboration (Papadonikolaki *et al.*, 2021). Supplier selection is another important strategy for adopting SCM practices in the construction industry. The selection of suppliers should be based on their ability to deliver quality products and services, and their willingness to collaborate with other stakeholders in the supply chain (Le *et al.*, 2021).

The use of technology can be used to improve supply chain visibility, which in turn can help organisations make better decisions and respond more quickly to changes in demand. For example, real-time tracking of inventory and shipments can help organisations identify and address supply chain disruptions (Chopra and Meindl, 2016). Digitalisation involves using digital technologies to improve SCM processes. This can include using big data analytics to optimise SC operations, implementing blockchain technology to enhance transparency and security in the SC, and using artificial intelligence (AI) and machine learning (ML) to automate SC processes. By embracing digitalisation, organisations can improve efficiency and reduce costs. (Sarkis *et al.*, 2021).

Singh *et al.* (2022) suggests that implementing proposed strategies in supply chain management (SCM) necessitates a thorough analysis of factors like technology adoption, contractor reward, training requirements, and grievance redressal. A responsive strategy

involves market research to capture market needs and respond quickly, focusing on the supply chain's ability to handle large demand, meet consumer needs, and handle demand uncertainty. Effective SCM implementation in the construction industry requires collaboration with suppliers and customers, fostering a culture of open communication, sharing knowledge, and rewarding innovation (Beamon, 2018). This can be achieved through joint ventures, partnerships, or alliances (Tang *et al.*, 2019). Investing in employee training and development, including training on SCM principles and specific tools and technologies, is crucial for ensuring employees have the knowledge and skills needed to effectively implement SCM practices. Inadequate training and lack of user participation can lead to SCM development failures (Fernie and Sparks, 2018), training should cover the benefits of SCM practices and the use of technology like BIM (Chen *et al.*, 2020).

Furthermore, implementing lean SCM practices is the right step in the right direction. Lean SCM practices involve minimising waste and inefficiencies in the SC. This can be achieved by reducing inventory, improving production processes, and optimising logistics. By implementing lean SC practices, organisations can improve efficiency and reduce costs. Lean principles have been identified as effective strategies for adopting SCM practices in the construction industry. This includes reducing waste, improving efficiency, and increasing collaboration between stakeholders (Yong *et al.*, 2020). Sustainable SCM involves minimising the environmental impact of supply chain activities. This can include reducing packaging waste, optimising transportation routes, and sourcing materials from sustainable sources. By implementing sustainable supply chain practices, organisations can enhance their reputation and appeal to customers who value sustainability (Seuring and Müller, 2008).

Waters (2018) further posited that developing a risk management plan is an effective step in the implementation of SCM. SC disruptions can have a significant impact on an organisation's operations and profitability. Construction firms need to develop a risk management plan that identifies potential risks and outlines the steps that will be taken to mitigate them. This plan should include contingency plans for dealing with supply chain disruptions (Waters, 2018). In addition, SCM is an ongoing process, and contracting organisations need to engage in continuous improvement to stay competitive. This can involve regularly reviewing and updating supply chain strategies and processes, as well as seeking feedback from customers and suppliers. By engaging in continuous improvement, organisations can identify and address issues before they become major problems (Ghiani *et al.*, 2018). Continuous improvement is an important strategy for adopting SCM practices in the construction industry. This involves continually evaluating and improving the effectiveness of SCM practices to ensure that they meet the changing needs of the industry (Yong *et al.*, 2020).

Developing a performance measurement system could reposition construction firms in the implementation of SCM. Contracting organisations need to develop a performance measurement system that allows them to track key performance indicators (KPIs) related to supply chain management. By tracking KPIs such as inventory turnover, delivery performance, and supply chain costs, organizations can identify areas for improvement and make data-driven decisions (Stadtler and Kilger, 2015). Performance measurement is critical for evaluating the effectiveness of SCM practices in the construction industry. This includes measuring the performance of suppliers, contractors, and other stakeholders in the supply chain (Shen *et al.*, 2020).

Ensuring compliance with regulations and standards is vital in the implementation of SCM. Contracting organisations need to ensure compliance with regulations and standards related to supply chain management. This can include regulations related to product safety, environmental sustainability, and labour practices. By ensuring compliance with regulations and standards, organizations can reduce the risk of legal and reputational issues (Carter and Rogers, 2008). Wang *et al.* (2020) posited that incentives and rewards can be used to encourage stakeholders to adopt SCM practices in the

construction industry. This includes providing financial incentives, such as bonuses or profit-sharing, for achieving project goals and objectives.

Many previous studies examined a company's strategy to develop and improve its competitiveness to be more competitive in the global market competition. To increase competitive advantage, companies must support their internal functions and communicate with supply chain partners effectively (Sundram *et al.*, 2016; Barata *et al.*, 2023). SCM practices positively impact competitive advantage. From several studies, it can be seen that there is a relationship between SCM practices and the competitive advantage of an organisation or company (Handoko *et al.*, 2017).

Top management support is crucial for the successful implementation of SCM in construction firms. This involves providing attention, resources, and authority to align the system with current business practices and prepare employees for the new technology (Seth *et al.*, 2015). Clear vision and change management are essential for successful implementation. Employees must be prepared for the changes and aligned with the organizational culture to avoid resistance and chaos (Seth *et al.*, 2015). Adopting SCM practices in the construction industry improves project efficiency, reduces costs, and improves project outcomes. Despite user resistance and reluctance to establish a company culture open to sharing business processes, the success rate of the system increases if aligned with the organisational culture. The implementation of SCM practices in the construction industry requires a multifaceted approach that involves collaborative relationships, information sharing, supply chain integration, supplier selection, performance measurement, training and education, risk management, lean principles, incentives and rewards, and continuous improvement. These enhancers help improve project outcomes, reduce costs, and increase stakeholder satisfaction.

3. METHODOLOGY

In establishing factors enhancing the implementation of SCM, this study adopted a survey design to generate quantitative data from construction firms operating in Nigeria. Survey design offers wide coverage, cost-effectiveness, speed, measurable results and objectivity in establishing these factors, hence its adoption by this study. The population of the study consist of 669 registered construction firms in Nigeria and was obtained from the registry of the Federation of the Construction Industry (FOCI), firms registered with construction professional bodies and preliminary investigations. The study is delimited to medium and large-scale construction firms. Focusing on construction firms is justified due to their importance, challenges, and potential for improvement in SCM in Nigeria. The study adopted stratified random sampling to aid in dividing the population into specific traits (medium and large-size construction firms), ensuring a representative sample and increasing estimate precision. This study focuses on staff strength in establishing firm characteristics. Medium-sized firms have a staff strength of 50≤ 200, and large-sized staff strength of >200. A sample size of 326 was achieved using the Taro Yamane formula (Yamane, 1967).

$$n = N/[1 + N(e)^2]$$

Where "n" is the sample size, "N" is the population and "e" is the level of confidence (95%).

Table 1: Sample Population of the Study

Firm Size	Population (N)	Sample size (n)
Medium-size	544	230
Large-sizes	126	96
Total	**670**	**326**

Furthermore, the primary way of gathering data for this study was through a questionnaire. The questionnaire survey is a rigorous strategy for obtaining data based on a sample. On a five-point Likert scale, the structured questionnaire's data were gathered. Each item was followed by a five-point Likert scale with the following values: 1-5, where

1= very low impact; 2 = low impact; 3 = moderate impact; 4 = high impact and 5 = very high impact. Furthermore, a total of 500 questionnaires were administered to construction firms to reduce the effect of non-response bias (Ekung *et al.*, 2021). This validated the related strategy objective to ensure that the response rate of a study is reasonably close to the minimum sample size. The study retrieved 421 questionnaires and 402 were fit for analysis; this produced a response rate of 80%. Cronbach's test of reliability was performed at 0.70 Alpha suggesting the variables are reliable for generalisation and Cronbach's alpha value between 0.70 and above shows strong internal coherency and dependability. The results of the study showed a Cronbach alpha value of 0.978 > 0.70 on 22 variables. Therefore, the inter-item consistency and instrument reliability are significant since values are above 0.70. This value indicates a high level of consistency and is within the acceptable threshold of 'good' reliability. Lastly, data generated were analysed using mean item scores, the coefficient of variation (COV) was calculated to liken the relative inconsistency of various responses, factor analysis and the Mann-Whitney U test to measure differences in perceptions.

4. PRESENTATION AND DISCUSSION OF RESULTS

This section presents data analysis relating to the objective and its associated hypothesis tests. The first section presents results relating to the characteristics of the respondents. Subsequent sections present data analysis and discussion of results.

4.1. Characteristics of the Respondents

Data relating to the respondents' characteristics is important to adjudicate whether information emerged from the targeted population. These data sets also provide background information about the respondents and the suitability of the data. The respondents' characteristics were determined using their level of education, professional qualifications, and years of experience in the industry. The data for this section were mainly categorical and the applied statistical tool was percentage.

Table 1: Characteristics of the Respondent

Categories	Variables	Frequency	Percentage
Gender	Male	342	85.1%
	Female	60	14.9%
Educational Qualification	HND/BSc	173	43.0%
	MSc/Ph.D	229	57.0%
Professional Affiliation	NIA	60	15%
	NIOB	40	10%
	NSE	80	20%
	NIQS	121	30%
	CIPSMN	101	25%
	Others	-	-
Professional Qualification	Registered member/Fellow	314	78%
	Probationer	88	22%
Years of Experience	0 – 5years	24	6%
	5 – 10 years	60	15%
	10 – 20 years	173	43%
	Above 20 years	145	36%
Number of Employees	Medium-scale (50-200)	273	68%
	Large-scale (200 and above)	129	32%

The result presented in Table 1 shows the characteristics of the respondents. 85.1% of the respondents are male and 14.9% are female. This reinforces that male dominates the

construction industry. The results presented further reveal the educational qualification of the respondents with 43% of the respondents having HND/BSc and 57% of the respondents possessing MSc/Ph.D. This educational qualification is adequate for the understanding of the research scope and purpose. From a perspective of professional affiliation, 15% of the respondents are architects (Nigerian Institute of Architects), 10% of the respondents are builders (Nigerian Institute of Building), 20% are engineers (Nigerian Society of Engineers), 30% are quantity surveyors (Nigerian Institute of Quantity of Surveyors). In comparison, 25% are supply chain managers (Chartered Institute of Purchasing and Supply Management of Nigeria). Meanwhile, 78% of the respondents are registered members/fellows of the aforementioned professional bodies and 22% are probationers. This portrays a high level of understanding of the construction process and ethics.

In terms of years of working experience, 6% had working experience between 0 – 5 years, 15% of the respondents had 5 – 10 years' experience, and 43% had 10 – 20 years' experience which is the highest among all categories and 36% of the respondent had experience above 20 years. This shows a good number of the respondents are experienced and share reliable information on SCM practices in the construction industry. The result presented in Table 1 shows that 68% of the respondents worked in medium-sized construction firms and 32% worked in large-size construction firms. This distribution is in tandem with the sample size. A well-designed SC is critical for construction firms to ensure success. The sample characteristics are therefore adequate to accept the perceptions of the respondents in the various areas of measurement determined by the study.

4.2. Factor Enhancing the Implementation of SCM Practices in Nigeria

The objective of the study is to examine effective strategies or enhancements that aid the implementation of SCM in Nigeria. Twenty-two (22) enhancers were extracted from the literature. The results of the field survey are analyzed using the mean item score and principal component analysis. The results presented in Table 2 show the descriptive perceptions of the respondents regarding factors enhancing the implementation of SCM by construction firms in Nigeria. Table 2 shows the hierarchy of 22 indicators based on the mean item score (MIS). The results presented in Table 2 show the implementation enhancers of medium-size construction firms in Nigeria, the results (MIS for medium-size firms) show only one category, namely: scores >3.00. This only means that medium-size construction firms descriptively agreed that these enhancers are significant in the implementation of SCM. The top five ranked factors enhancing the implementation of SCM are undertaking digital transformation/technological innovation, top management support, external support (vendors, subcontractors, government, among others), developing adequate knowledge and experience, change management (readiness for change) and ensure compliance with regulations and standards.

The results presented in Table 2 also show the implementation enhancers of large-size construction firms in Nigeria, the results show only one category, namely: scores >3.00. This only means that large-size construction firms descriptively agreed that these enhancers are significant in the implementation of SCM. The top five ranked factors enhancing the implementation of SCM are undertaking digital transformation/technological innovation, top management support, external support (vendors, subcontractors, government, among others), developing adequate knowledge and experience and responsive strategy. Meanwhile, the aggregated sample also shows only one category of MIS, scores > 3.00. This means the enhancers evaluated by the study are significant for implementing SCM in Nigeria. The aggregated sample shows the top five most significant enhancers/strategies which are undertaken by digital transformation/technological innovation, top management support, external support (vendors, subcontractors, government, among others), developing adequate knowledge and experience, change management (readiness for change), ensure compliance with regulations and standards, and responsive strategy. Furthermore, besides MIS, the coefficient of variation (COV) was calculated to liken the relative inconsistency of

various responses. It signifies the standard deviation as a percentage of the mean: it is a degree of predictability of evaluating bias. Therefore, a large COV portrays that the evaluated bias is dispersed and unpredictable. COV was computed using equation (1) from Elhag *et al.* (2005): COV = **S/** μ X 100%.

Table 2: Factors Enhancing the Implementation of SCM Practices

	Medium Size Firm		**Large Size Firm**		**Aggregated Sample**		
Factor Enhancing	**Mean**	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**	**Remarks**
Undertake digital transformation/technological innovation	3.90	1st	3.94	1st	3.92	1st	Significant
Top management support	3.76	2nd	3.78	2nd	3.77	2nd	Significant
External support (vendors, subcontractors, government, e.t.c.)	3.69	3rd	3.71	3rd	3.70	3rd	Significant
Develop adequate knowledge and experience	3.54	4th	3.56	4th	3.55	4th	Significant
Change management (Readiness for change)	3.44	5th	3.45	6th	3.44	5th	Significant
Ensure compliance with regulations and standards	3.44	5th	3.45	6th	3.44	5th	Significant
Responsive strategy	3.43	7th	3.46	5th	3.44	5th	Significant
Invest in employee training and development	3.43	7th	3.44	9th	3.43	8th	Significant
Focus on the core strength of the firm	3.42	9th	3.45	6th	3.43	8th	Significant
Selecting competent supplier	3.40	10th	3.44	9th	3.42	10th	Significant
Customer focus	3.40	10th	3.38	16th	3.39	11th	Significant
Developing a risk management plan	3.39	12th	3.39	12th	3.39	11th	Significant
Supply chain integration	3.38	13th	3.39	12th	3.39	11th	Significant
Adopts clear vision	3.38	13th	3.39	12th	3.39	11th	Significant
Continuous improvement across all levels	3.37	15th	3.41	11th	3.39	11th	Significant
Synchronization of logistics processes	3.36	16th	3.39	12th	3.38	16th	Significant
Developing a performance measurement system	3.33	17th	3.34	18th	3.33	17th	Significant
Contractor reward and recognition (incentive and reward)	3.31	18th	3.35	17th	3.33	17th	Significant
Effective collaboration with suppliers and customers	3.31	18th	3.33	19th	3.32	19th	Significant
Trust among SC partners	3.31	18th	3.33	19th	3.32	19th	Significant
Effective communication	3.25	21st	3.17	22nd	3.21	22nd	Significant
Information Sharing	3.21	22nd	3.24	21st	3.23	21st	Significant

Where S: standard deviation and μ: mean.

The result presented in Table 3 shows COV of factors inhibiting the implementation of SCM ranged between 21.7 and 29.1 percent, signifying that the disparities in respondents' attitudes related to factors enhancing the implementation of SCM practices are relatively low. This is a good indication that validates a high level of agreement between the respondents. The threshold above 40% indicates a low level of agreement among respondents (Elhag *et al.*, 2005). if medium and large construction firms in Nigeria have a COV below 40% in their SCM practices, it suggests that they have a relatively consistent and stable approach to managing their SC. This implies that the firms have already implemented some measures that enhance the implementation of SCM.

Conclusively, a low COV portrays that construction firms in the study areas have a good understanding of the processes involved in their SC. By focusing on factors that enhance the implementation of SCM, these firms can further improve their efficiency and effectiveness in managing SC.

Table 3: COV of Factors Enhancing the Implementation of SCM

Factors Enhancing SCM	μ	ɛ	COV (%)
Undertake digital transformation/technological innovation	3.92	0.86920	22.1
Top management support	3.77	0.82045	21.7
External support (vendors, subcontractors, government and others)	3.70	0.91394	24.7
Develop adequate knowledge and experience	3.55	0.92316	26.0
Change management (Readiness for change)	3.44	0.87441	25.4
Ensure compliance with regulations and standards	3.44	0.87441	25.4
Responsive strategy	3.44	0.80914	23.3
Invest in employee training and development	3.43	0.85141	25.4
Focus on the core strength of the firm	3.43	0.92264	26.8
Selecting competent supplier	3.42	0.91586	26.7
Customer focus	3.39	0.93054	27.4
Developing a risk management plan	3.39	0.80382	23.7
Supply chain integration	3.39	0.93317	27.5
Adopts clear vision	3.39	0.93317	27.5
Continuous improvement across all levels	3.39	0.87231	25.7
Synchronization of logistics processes	3.38	0.97787	28.9
Developing a performance measurement system	3.33	0.86372	25.9
Contractor reward and recognition (incentive & reward)	3.33	0.79356	23.8
Effective collaboration with suppliers and customers	3.32	0.90208	27.1
Trust among SC partners	3.32	0.96859	29.1
Effective communication	3.21	0.82526	25.7
Information Sharing	3.23	0.82410	25.1

μ = mean; ɛ = standard deviation

4.3. Test of Difference in respondents' perceptions of Factors Enhancing the Implementation of SCM

To determine the level of consistency in the perception of respondents in the factors enhancing the implementation of SCM in construction firms, the study tested the hypothesis, which states that there is no significant difference in factors enhancing the implementation of SCM between medium and large-scale construction firms in Nigeria. The study applied the Mann-Whitney U test to measure differences in perceptions and levels of agreement in ranking perceptions of respondents about factors enhancing the implementation of SCM.

Table 4: Test of variation in respondents' perceptions

Items compared	The extent of the difference in respondents' perceptions
No of variables (N)	22
Medium-size firms	20.95
Large-size firms	24.04
Mann-Whitney U	208.000
Wilcoxon W	461.000
p-value	0.424
Significance level	0.050
Decision	Accept

The test was validated using the critical p-values where values greater than 0.05 were accepted and values less than 0.05 were rejected. The results presented in Table 4 show that the perceptions of construction firms do not vary. The critical p-value (0.424) is greater than 0.05 and the null hypothesis was accepted. Therefore, the differences in the

rating perceptions of respondents about the factors enhancing the implementation of SCM in construction firms are similar.

4.4. Exploratory Factor Analysis

Exploratory factor analysis (EFA) is a statistical technique that can be used to identify the key factors that enhance the implementation of SCM in Nigeria. EFA is useful in this context due to complexity of SCM, lack of prior research, data-driven approach, identification of latent variables and development of measurement scale. Overall, EFA provides systematic and objective approach to understand the complex dynamics of SCM and improve its implementation. The factor analysis examined the extent and pattern of the relationship, to archive this, Pallant (2020) significance level of the correlation matrix for values greater than 0.05, and the correlation coefficient for values greater than 0.9 was used. However, due to the complexity of the correlation matrix was used (Pallant, 2020). The determinant is 1.286E-5 (0.0001286). This value is greater than 0.00001(Pallant, 2020). The results, therefore, mean the absence of multicollinearity in the data set. Multicollinearity explains the presence of a highly correlated factor (R > 0.9) (Pallant, 2020); and data without this threat reflects that the data collection instrument was appropriate. This analysis further provides the second reliability to Cronbach tests earlier presented. The relevant factors enhancing the implementation of SCM are related and correlate fairly well.

Table 5: KMO and Bartlett's Test of Identity Matrix

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.708
Bartlett's Test of Sphericity	Approx. Chi-Square	842.365
	Df	210
	Sig.	0.000

a. Determinant = 1.286E-5

The study also evaluated sampling adequacy using Kaiser-Mayer-Olkin (KMO) and Bartlett's test of sphericity. The appropriate sample has a KMO value greater than 0.5 (Pallant, 2020), but the study yielded a KMO value (0.708 > 0.50) and this is close to one. KMO close to one indicates that the order of correlations is relatively compact, and dimension reduction will generate reliable factors. According to Pallant (2020), KMO values of 0.7 and 0.8 are fairly good. Bartlett's test, on the other hand, indicates that the samples are related. The KMO was also conducted to determine whether the correlation matrix is not an identity matrix. Based on data in Table 5, the null hypothesis (that is, the correlation matrix is not an identity matrix) is rejected (0.000 < p = 0.05); and the inference is that the correlation matrix (R-matrix) is not an identity matrix but have some relationship between variables. The Bartlett test is therefore highly significant.

The exploratory factor analysis generated three principal components. The initial exploratory extraction created 22 factors with Eigen values greater than 1 but with significant variance explained by only three factors (see appendix I). Only three factors, therefore, produce an Eigenvalue greater than the 1.00 benchmark used in the analysis (15.670; 2.067 and 1.899 – Table 6). The nineteen (86%) extracted factors, therefore, explained only an insignificant proportion of the enhancers/strategies critical to the implementation of SCM in Nigeria. The 19 enhancers are also responsible for an insignificant 10.75% variation in the sample, while 3 (14%) factors account for 89.25% of the variation in the entire sample.

The study further analysed the commonality test. The Communality was conducted to measure commonness in the spread of the factors. This result is important to direct the number of factors to be extracted and in this case, is three (3). The three factors are valid since the number of constructs is less than 30, and the average of the commonality's total significance – column two Table 6 (19.636/22 = 0.89) > 0.70 (Field, 2005). Therefore, three principal factors can be grouped from the 22 enhancers identified from the literature as strategies/enhancers critical for the implementation of SCM in Nigeria.

Table 6: Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	15.670	71.227	71.227
2	2.067	9.397	80.624
3	1.899	8.633	89.257

4.5. Principal Factor Analysis

Factor rotation was further conducted to suppress loading less than 0.40 to make the interpretation easier. Using oblique rotation (see appendix II, for loading of the variables), three factors are therefore loaded onto the component matrix, and a scan through the various factors loading indicates the most significant loading in factor one has a score of 0.955, this component relates to continuous improvement across all levels (Table 7). The study, therefore, selected the framing 'continuous improvement' for this factor.

Table 7: Factor Enhancing' Rotated Principal Component Matrix

	Component		
Firm Performance	1	2	3
Continuous improvement	0.955		
Competitive advantage		0.899	
Digitalisation			0.959

Furthermore, under the second factor, the most significant loading has a value of 0.899, this component relates to the focus on the core strength of the firm, and the frame 'competitive advantage' was selected for factor two (2). The most critical strategies/enhancers under the third relate to undertaking digital transformation/technological innovation (0.959), and the framing 'digitalisation' is adopted. These three factors are vital in the implementation of SCM by construction firms in Nigeria.

4.6. Discussion of Result

The results of the study reveal that undertaking digital transformation/technological innovation, top management support, external support (vendors, subcontractors, government, among others), developing adequate knowledge and experience, change management (readiness for change) and ensuring compliance with regulations and standards are critical factor enhancing the implementation of SCM by construction firms in Nigeria. From these results, the study infers that the level of implementation of SCM can be facilitated by focusing on the revealed important variables. Notably, 22 factors evaluated had MIS above 3.00, this means that these evaluated can significantly improve the implementation of SCM by both medium and large-size construction firms in Nigeria. Stakeholders perceived and considered the validated factors pertinent solutions that can improve SCM in Nigeria. Mainstreaming these elements into organisation reforms and structures would position construction firms to stimulate greater SCM performance. The implications of these findings are that construction firms should focus on implementing all the 22 factors to enhance the implementation of SCM. Construction firms should identify and prioritize the factors that are most relevant to their SCM goals and objectives. Construction firms should provide adequate resources, including financial, human, and technological resources, to support the implementation of these factors. Construction firms should ensure that there is adequate training and development for employees involved in the implementation of SCM. Construction firms should establish effective communication and collaboration among all stakeholders involved in the SC.

One key critical strategy for the implementation of SCM is undertaking digital transformation. Digital transformation has been projected to revolutionize the construction industry and it offers improved delivery of materials and also eliminates delays. Undergoing digital improves supply chain visibility. Technology can be used to improve supply chain visibility, which in turn can help organisations make better decisions and respond more quickly to changes in demand. For example, real-time

tracking of inventory and shipments can help organisations identify and address supply chain disruptions (Chopra and Meindl, 2016). This viewpoint is consistent with the position reported by Sarkis *et al.* (2021). Sarkis *et al.* (2021) postulated that digitalisation will improve SCM practices. This can include using big data analytics to optimise SC operations, implementing blockchain technology to enhance transparency and security in the SC, and using artificial intelligence (AI) and machine learning (ML) to automate SC processes. By embracing digitalisation, organisations can improve efficiency and reduce costs (Sarkis *et al.*, 2021). Singh *et al.* (2022) further agreed that implementing SCM requires an in-depth analysis of various factors such as the latest technology adoption, contractor reward and recognition, training requirements and grievance redressal.

Furthermore, implementing SCM requires key support from the top management team as they play a key role in implementing SCM. Top management support describes the extent to which executive managers of the adopting firm provide the attention, resources, and authority required for SCM implementation (Seth *et al.*, 2015). The top management has the responsibility to align the SCM system with the current business practices and prepare the employees for the change brought by the new technology (Seth *et al.*, 2015). With top management support, top executives can partially mitigate user resistance by encouraging or even mandating, user engagement in the implementation.

Improving the implementation of SCM requires external support, compliance with regulations and standards, and readiness for change which can be enhanced through collaboration. Collaboration with suppliers and compliance with regulations is essential for effective SCM. Construction firms need to work closely with their suppliers to ensure that they understand the organisation's needs and can provide the necessary goods and services on time and at the right price. Similarly, construction firms should also collaborate with their customers to understand their needs and preferences and to ensure that they receive the products or services they need (Beamon, 2018). Collaborative relationships between stakeholders are a key strategy for adopting SCM practices in the construction industry. These relationships can be established through joint ventures, partnerships, or alliances (Tang *et al.*, 2019). The result of the study also reinforces the need for adequate knowledge and experience. Knowledge and experience can be improved through training and development. To effectively implement SCM, construction firms need to invest in employee training and development. This can include training on SCM principles, as well as training on specific tools and technologies used in SCM. A study by Fernie and Sparks (2018) showed that by investing in employee training and development, construction firms can ensure that their employees have the knowledge and skills needed to effectively implement SCM practices. Similarly, Seth *et al.* (2015) posited inadequate training for the team members and lack of user participation in the project as one of the SCM development failure factors. The main goal of the training should be the effective understanding of the various business processes and should address all aspects of the system.

Furthermore, 22 factor enhancers variables found in literature were abridged into a more frugal set using factor analysis which three (3) factors discussed below were found to account for most of the variance in the data set.

Continuous Improvement: The principal component underlying this frame is continuous improvement. Continuous improvement is a critical component responsible for the implementation of SCM, this is because SCM is a complex and dynamic process that requires ongoing evaluation and optimization to ensure its efficiency and effectiveness. Factors in this category include continuous improvement across all levels, contractor reward and recognition (incentive and reward), responsive strategy, developing a performance measurement system, adopting a clear vision, supply chain integration, selecting competent suppliers, developing a risk management plan, information sharing, effective collaboration with suppliers and customers, change management (readiness for change), ensure compliance with regulations and standards and invest in employee training and development. Interestingly, continuous improvement embodied these aforementioned factors. By continuously improving SCM practices and processes,

construction firms can identify and eliminate bottlenecks, streamline processes, and reduce costs. By engaging in continuous improvement, organisations can identify and address issues before they become major problems (Ghiani *et al.*, 2018), this can lead to increased profitability, improved customer satisfaction and a competitive advantage in the market. Furthermore, continuous improvement helps construction firms to adapt to changing market conditions and customer demands. By staying agile and responsive, construction business can quickly adjust their SC processes to meet new challenges and opportunities. This finding corroborated the opinion of Yong *et al.* (2020) and revealed that continuous improvement is an important strategy, and it involves continually evaluating and improving the effectiveness of SCM practices to ensure that they meet the changing needs of the industry (Yong *et al.*, 2020).

Continuous improvement is an ongoing effort to improve processes, products, and services by making incremental changes overtime. In this context of SCM, continuous improvement can contribute to increased efficiency, improved quality, improved agility, increased innovation, and improved collaboration among supply chain partners. Overall, continuous improvement can significantly improve the implementation of SCM in Nigeria.

Competitive Advantage: The first and second component of the factor analysis underlying this frame is competitive advantage. The factors in this category focus on the core strength of the firm, developing adequate knowledge and experience, external support (vendors, subcontractors, government, among many others), synchronisation of logistics processes, and trust among SC partners. This study frames these factors as competitive advantages as they reflect the need to implement SCM in an ever-expanding construction business. The critical goal of any construction firm in implementing SCM is to remain competitive in an expanding construction market (Elmughrabi *et al.*, 2020). Competitive advantage is critical for the survival of any construction firm. A well-managed SC can provide significant competitive advantages to a business by increasing efficiency, reducing costs, and improving customer satisfaction. By implementing SCM, construction firms can optimize their inventory levels, improve their delivery times and reduce the lead time for their products. This can enable them to respond more quickly to customer demand and gain a competitive advantage over their rivals. Furthermore, SCM can help businesses reduce costs by improving the efficiency of their operations, reducing waste, and optimizing their SC network. This can enable them to offer their products at a lower price than their competitors, making them more attractive to customers. Furthermore, it is critical to note that the company's primary resources, are a source of competitive advantage, but are limited to resources within the company's organisation and the organisation as part of the SCM systems. An important task for top management is to manage the SC at the most cost-efficient level while maintaining commendable flexibility in building relationships with suppliers to respond to customer needs (Nurdianti *et al.*, 2017). Currently, many factors trigger companies to compete to create innovative products (Barata *et al.*, 2023). This is done to increase competitive advantage. A well-integrated network within a corporation is essential for increasing this competitiveness. Companies in the production, importation, and service industries have long recognised the value of optimising their supply chains to cut costs and improve their position in the market (Barata *et al.*, 2023). Within this context, competitive advantage can contribute to the implementation of SCM by providing cost savings, improved quality, faster delivery times, improved innovation and improved customer service.

Digitalisation: The principal component underlying this frame is digitalisation. Digitalisation is a critical component for the successful implementation of SCM. The role of digitalisation is critical to implementing SCM, the principal framing relating to this factor is therefore consistent with extant literature. Sarkis *et al.* (2021) posited that by embracing digitalisation, construction firms can improve efficiency and reduce costs. (Sarkis *et al.*, 2021). With the increasing complexity of SC operations, digitalisation has become essential to optimise processes, improve efficiency and reduce costs. Going digital, construction firms can gain real-time visibility into their operations, allowing them to identify and address bottlenecks and inefficiencies quickly. Digitalisation also

enables construction firms to track their inventory levels, monitor their supplier's performance and optimise their transportation and logistics networks. Digitalisation allows greater collaboration and communication between SC partners. SC integration involves the coordination and collaboration of all stakeholders in the supply chain. This can be achieved through the use of technology, such as Building Information Modelling (BIM), to facilitate communication and collaboration (Papadonikolaki *et al.*, 2021). Information sharing can be optimised using digital technologies (Kim *et al.*, 2019). Digitalisation enables the use of technologies such as the Internet of Things, artificial intelligence and machine learning to automate and optimise SC processes further. Digitalisation can be used to improve SC visibility, which in turn can help construction firms make better decisions and respond more quickly to changes in demand. For example, real-time tracking of inventory and shipments can help organisations identify and address supply chain disruptions (Chopra and Meindl, 2016). However, undergoing digital transformation is the sole role of top management. Top management support describes the extent to which construction executive managers of the adopting firm provide the attention, resources, and authority required for SCM implementation (Seth *et al.*, 2015). The top management has the responsibility to align the SCM system with the current business practices and prepare the employees for the change brought by the new technology (Seth *et al.*, 2015). However, not going digital, means the SC process will be executed manually which exposes SC to late delivery, which in turn affects the efficiency of SCM. Furthermore, digitalisation can contribute to the implementation of SCM by improving visibility, efficiency, collaboration, decision-making, and customer service.

5. CONCLUSION AND RECOMMENDATIONS

The implementation of SCM in emerging markets has begun and advanced in the last years, however, it is still in its infancy when compared to research on developed countries. However, factors such as undertaking digital transformation/technological innovation, top management support, external support (vendors, subcontractors, government among others), developing adequate knowledge and experience, change management (readiness for change) and ensuring compliance with regulations and standards are effective for enhancing the implementation of SCM in Nigeria. The principal factors revealed are continuous improvement, competitive advantage and digitalisation. The successful integration of these factors could result in improved efficiency, cost reduction, increased profitability, and enhanced customer satisfaction. Additionally, it leads to better risk management and improved decision-making processes. The construction industry has become increasingly competitive, and firms that implement effective SCM gain a competitive advantage over their rivals. This implies that firms should prioritise these enhancers to implement SCM to remain competitive and achieve sustainable growth. Furthermore, the construction industry should continue to explore innovative ways to enhance SCM practices for improved performance and customer satisfaction. The study recommends investments in digital transformation, training and skill development programs for enhancement of SCM capabilities. This includes providing training on procurement strategies, inventory management techniques, and effective communication skills. One noticeable limitation of the study is the fact that study only focused on medium and large-size construction firms, neglecting small firms' perspectives and experiences, therefore the findings of the study may not be genialize. However, further studies can be carried out on small firms and other sectors of the Nigerian economy.

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APPENDICES

Appendix 1: Total Variance Explained

	Initial Eigenvalues		
Component	Total	% of Variance	Cumulative %
1	15.670	71.227	71.227
2	2.067	9.397	80.624
3	1.899	8.633	89.257
4	.873	3.967	93.224
5	.481	2.187	95.411
6	.425	1.933	97.344
7	.244	1.111	98.455
8	.169	.768	99.224
9	.057	.257	99.481
10	.047	.212	99.693
11	.032	.145	99.838
12	.024	.108	99.946
13	.011	.050	99.996
14	.001	.004	100.000
15	1.110E-14	5.044E-14	100.000
16	3.467E-15	1.576E-14	100.000
17	6.144E-16	2.793E-15	100.000
18	-1.457E-16	-6.622E-16	100.000
19	-2.806E-16	-1.275E-15	100.000
20	-4.963E-16	-2.256E-15	100.000
21	-3.133E-15	-1.424E-14	100.000
22	-6.504E-15	-2.956E-14	100.000

Appendix II: Factor Enhancing Principal Factor Analysis

Rotated Component Matrix			
Factors	Component		
	1	2	3
Continuous improvement across all levels	.955		
Contractor reward and recognition (incentive & reward)	.915		
Responsive strategy	.899		
Developing a performance measurement system	.896		
Adopts clear vision	.856	.470	
Supply chain integration	.856	.470	
Selecting competent supplier	.850		
Developing a risk management plan	.831	.454	
Information Sharing	.806	.501	
Effective collaboration with suppliers and customers	.795		
Change management (Readiness for change)	.793	.529	
Ensure compliance with regulations and standards	.793	.529	
Invest in employee training and development	.774		
Customer focus	.682	.646	
Effective communication	.591	.505	
Focus on the core strength of the firm		.899	
Develop adequate knowledge and experience		.891	
External support (vendors, subcontractors, government, among otherst.c.)		.876	
Synchronisation of logistics processes	.452	.824	
Trust among SC partners	.505	.787	
Undertake digital transformation/technological innovation			.959
Top management support			.936

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.